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DEPARTMENT OF THE ARMY
TECHNICAL MANUAL

DEPARTMENT OF THE AIR
FORCE PAMPHLET

# TM 8-640
# AFP 160-14-1

# JOINT MOTION MEASUREMENT

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*DEPARTMENTS OF THE ARMY AND THE AIR FORCE*
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TECHNICAL MANUAL
No. 8–640
AIR FORCE PAMPHLET
No. 160–14–1

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., *30 March 1956*

# JOINT MOTION MEASUREMENT

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# SECTION I
# INTRODUCTION

## 1. Purpose

The purpose of this manual is to provide uniform information and instruction to personnel concerned with the use of Standard Form 527a, Joint Motion Measurements.

## 2. Definitions

*a. Goniometer*

(1) The double armed universal goniometer or equivalent is to be used for all measurements except when the gravity type goniometer is selected as the method of choice (figs. 1 and 2).

(2) For purposes of this manual, stationary arm and movable arm referred to in the procedure, pertain to the stationary and movable portions of the instrument utilized as the measuring device.

*b. Numerical Expression of Joint Motion*

(1) In general, the anatomical position is considered as 0°. There are two major exceptions—

(*a*) Shoulder rotation (Arm abducted to 90°, elbow flexed to 90° and forearm in mid-position between supination and pronation) (fig. 15).

(*b*) Supination and pronation (elbow flexed to 90°, forearm in mid-position between supination and pronation) (figs. 17a and 17b).

(2) In both exceptions, the position described is considered 0°, and the motion increases from 0° to 90° in both directions.

(3) In some instances (e.g., ankle motion—figs. 8 and 9), the actual goniometer reading will be 90° at the starting position, but this shall be considered 0°, and the range of motion read accordingly.

(4) Axis of Motion: The axis of motion may shift as joint movement occurs. The arms of the goniometer should be properly realined so that the pivot of the protractor will fall as closely as possible to the axis of motion.

## 3. Joint Motion and Range

| Joint | Movement | Range of motion in degrees |
|---|---|---|
| Hip | Flexion | 0–125 |
| | Extension | 0–10 |
| | Adduction | 0–40 |
| | Abduction | 0–45 |
| | Internal rotation | 0–45 |
| | External rotation | 0–45 |
| Knee | Extension | 0– |
| | Flexion | 0–140 |
| Ankle | Planter flexion | 0–45 |
| | Dorsi flexion | 0–20 |
| Foot | Inversion | 0–40 |
| | Eversion | 0–20 |
| Shoulder | Extension | 0–45 |
| | Flexion | 0–180 |
| | Adduction | 0–40 |
| | Abduction | 0–180 |
| | Internal rotation | 0–90 |
| | External rotation | 0–90 |
| Elbow | Extension | 0– |
| | Flexion | 0–145 |
| Forearm | Supination | 0–90 |
| | Pronation | 0–90 |
| Wrist | Extension | 0–70 |
| | Flexion | 0–80 |
| | Ulnar deviation | 0–45 |
| | Radial deviation | 0–20 |
| Thumb | Flexion | |
| | Metacarpophalangeal | 0–60 |
| | Interphalangeal | 0–90 |
| | Abduction | |
| | Radial | 0–55 |
| | Palmar | 0–45 |
| Finger | Flexion | |
| | Metacarpophalangeal | 0–90 |
| | Proximal interphalangeal | 0–120 |
| | Distal interphalangeal | 0–80 |
| | Extension | |
| | Metacarpophalangeal | 0–25 |
| | Proximal interphalangeal | 0– |
| | Distal interphalangeal | 0– |
| | Abduction | 0–30 |

## 4. Instruments

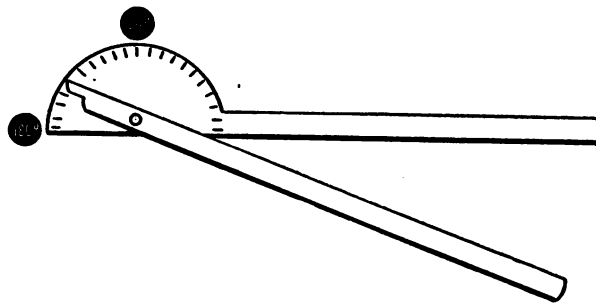


*Figure 1. Double armed universal goniometer.*

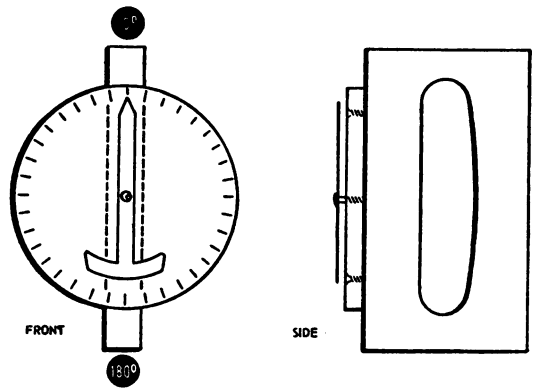
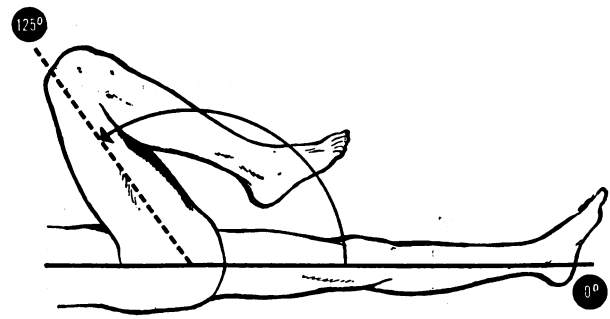



*Figure 2. Gravity type goniometer for supination and pronation.*

# SECTION II
# PROCEDURE FOR JOINT MEASUREMENT

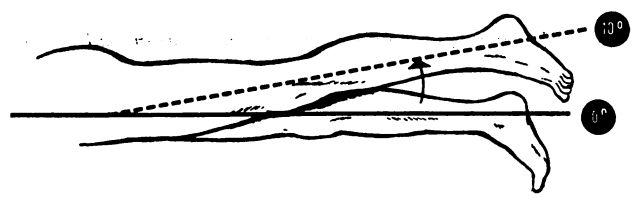
## 5. The Hip




*Flexion* (fig. 3)

1 *Position*—Supine, knee flexed; opposite knee and hip straight
2 *Stationary arm*—Parallel to long axis of trunk
3 *Moving arm*—In line with lateral midline of femur

*Figure 3.*

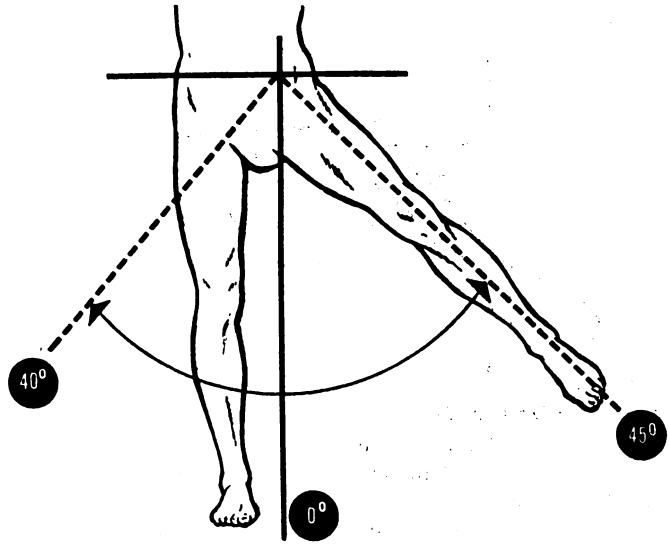



*Extension* (fig. 4)

1 *Position*—Prone*
2 *Stationary arm*—Parallel to long axis of trunk
3 *Moving arm*—In line with lateral midline of femur

*Figure 4.*

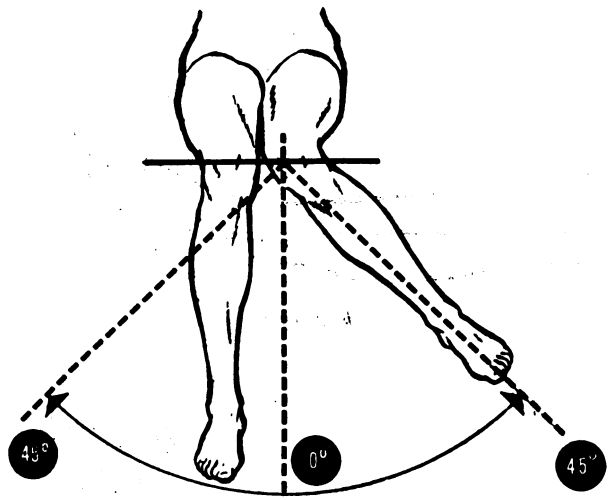
* If extension is less than 0°, measure in supine position, with pelvis stabilized.




*Adduction and Abduction* (fig. 5)

1 *Position*—Supine
2 *Stationary arm*—Perpendicular to a line between anterior superior iliac spines.
3 *Moving arm*—In line with anterior midline of femur

*Figure 5.*

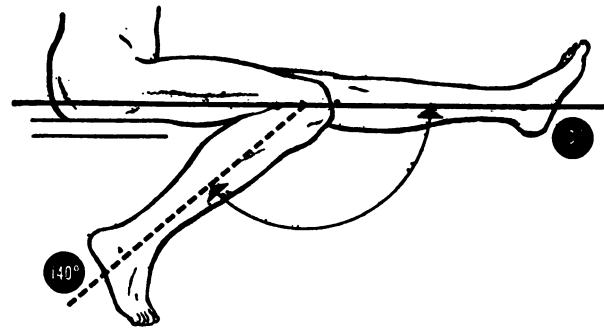



*Internal and External Rotation* (fig. 6)

1 *Position*—Sitting with knee flexed to 90°
2 *Stationary arm*—Parallel to table top
3 *Moving arm*—In line with anterior tibial crest

*Figure 6.*

## 6. The Knee




*Extension and Flexion* (fig. 7)

1 *Position*—Sitting with knee flexed
2 *Stationary arm*—Parallel to femur on a line from the lateral condyle to greater trochanter.
3 *Moving arm*—Parallel to fibula on line with lateral malleolus

*Figure 7.*

## 7. The Ankle

*Plantar Flexion and Dorsi Flexion* (figs. 8 and 9)

1 *Position*—Supine with heel over edge of table and knee extended
2 *Stationary arm*—Parallel to fibula
3 *Moving arm*—In line with the lateral edge of the heel and the head of the 5th metatarsal.

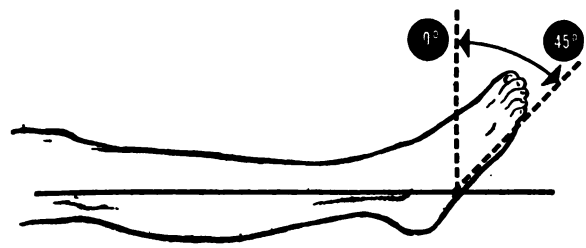



*Figure 8.*

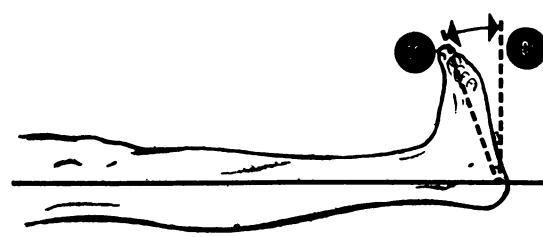
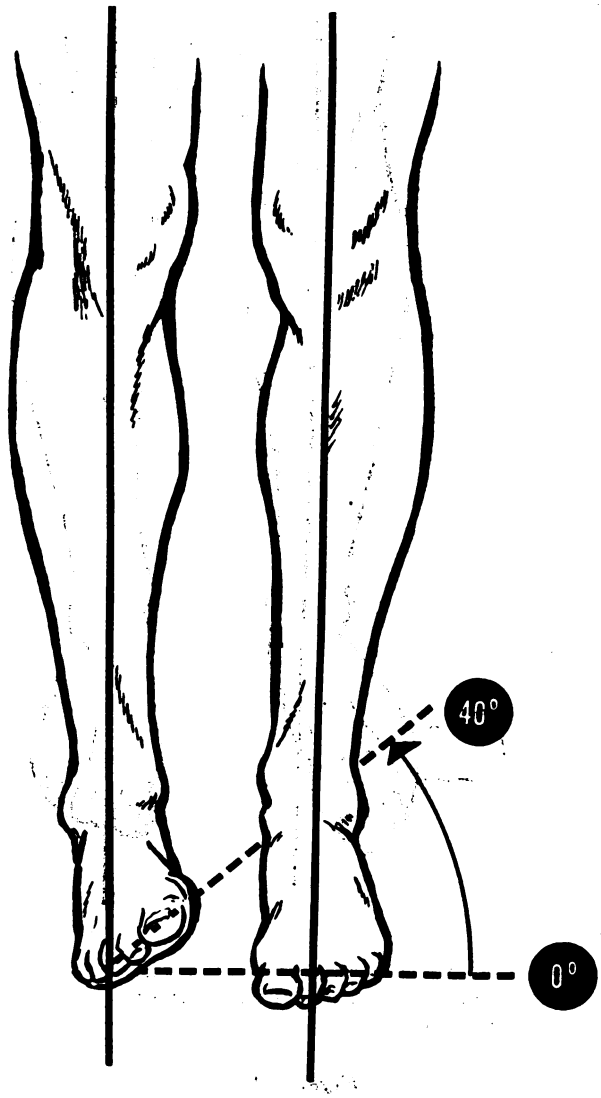


*Figure 9.*

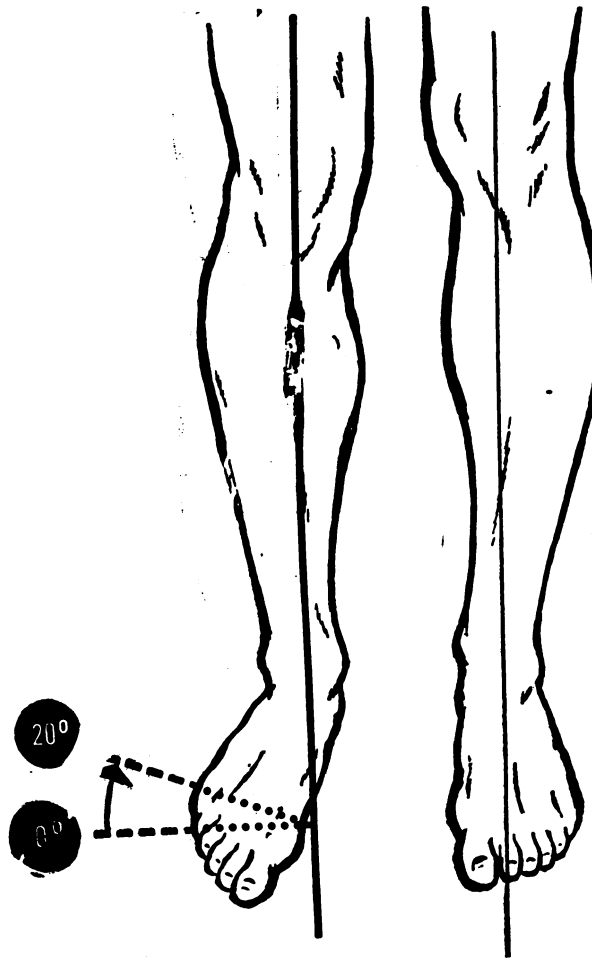
## 8. The Foot




*Inversion* (fig. 10)

1 *Position*—Supine with heel over edge of table and knee extended
2 *Stationary arm*—Parallel to anterior tibial crest
3 *Moving arm*—Across ball of foot

*Figure 10.*

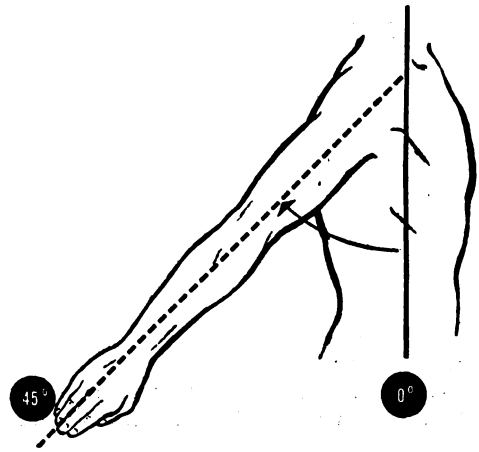



*Eversion* (fig. 11)

1 *Position*—Supine with heel over edge of table and knee extended
2 *Stationary arm*—Parallel to anterior tibial crest
3 *Moving arm*—Across ball of foot

***Figure 11.***

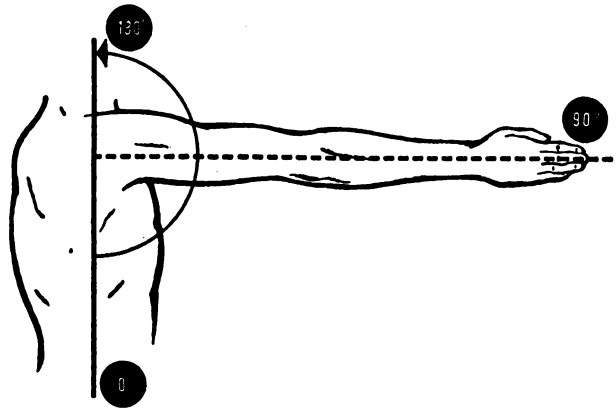
## 9. The Shoulder




*Extension* (fig. 12)

1 *Position*—Standing, sitting, or prone, with elbow extended. Palm facing medially. Measure from lateral aspect of body.
2 *Stationary arm*—Along mid-axillary line of trunk
3 *Moving arm*—Along lateral midline of humerus

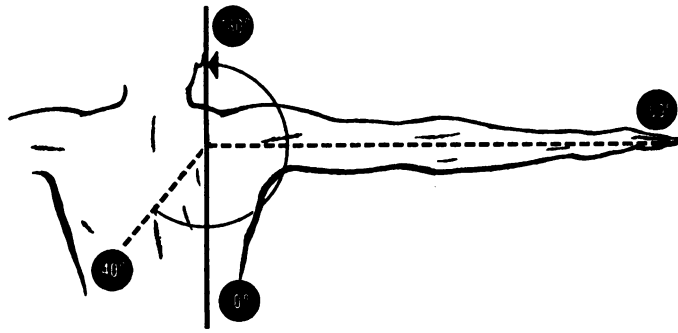
*Figure 12.*




*Flexion* (fig. 13)

1 *Position*—Standing, sitting, or supine with elbow extended. Palm facing medially. Measure from lateral aspect of body.
2 *Stationary arm*—Along mid-axillary line of trunk
3 *Moving arm*—Along lateral midline of humerus

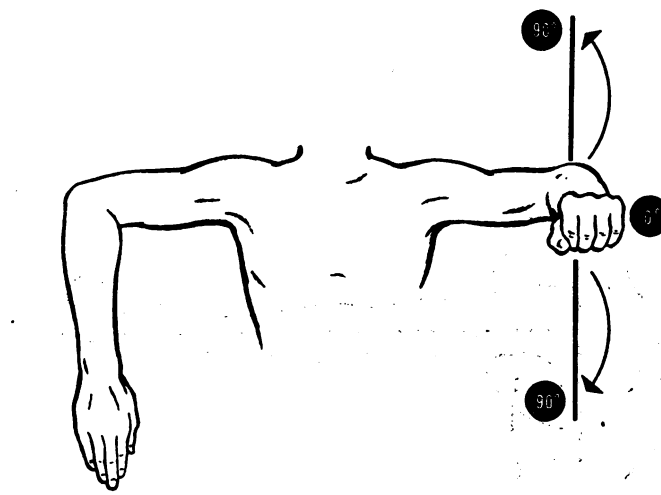
*Figure 13.*



*Adduction and Abduction* (fig. 14)

1 *Position*—Standing or sitting
2 *Stationary arm*—Parallel to spine, but at lateral aspect of body
3 *Moving arm*—Parallel to midline of humerus toward olecranon process

*Figure 14.*

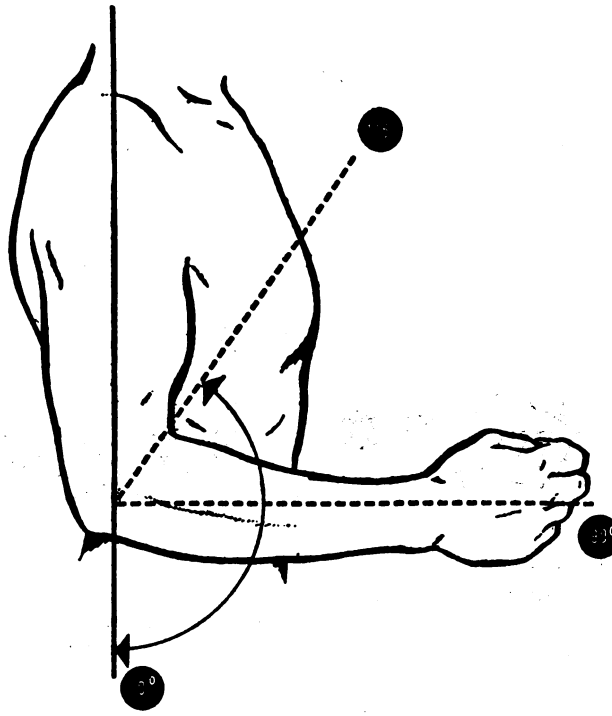


*Internal and External Rotation* (fig. 15)

1 *Position*—Patient supine. Arm abducted to 90°, elbow flexed to 90°, forearm in mid-position between supination and pronation, and perpendicular to table top. Humerus in contact with table top.
2 *Stationary arm*—Parallel to table top with axis on olecranon process
3 *Moving arm*—On line with styloid process of ulna

*Figure 15.*

## 10. The Elbow

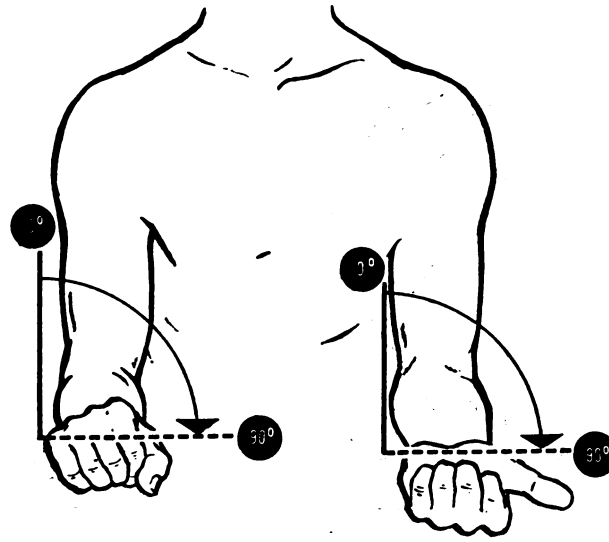


*Extension and Flexion* (fig. 16)

1 *Position*—Standing, sitting, or supine. Forearm in mid-position between supination and pronation.
2 *Stationary arm*—Along midline of humerus
3 *Moving arm*—Along midline of dorsal aspect of forearm

*Figure 16.*

## 11. The Forearm



*Supination* (A, fig. 17)

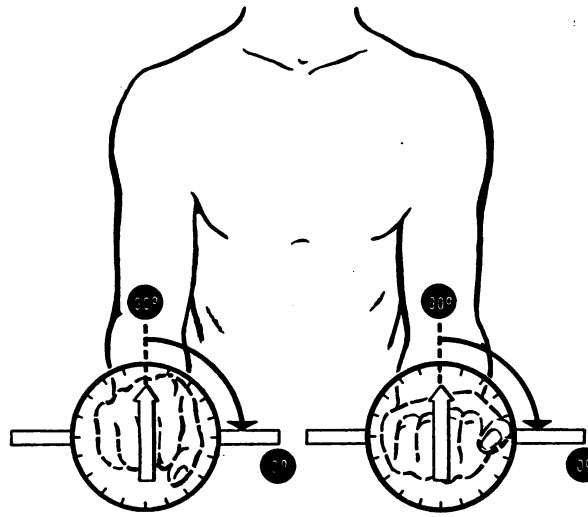
1 *Position*—Sitting or standing, with elbow flexed to 90°, forearm in mid-position between supination and pronation. Elbow held close to body.
2 *Stationary arm*—Parallel to long axis of humerus with protractor medial to wrist.
3 *Moving arm*—Placed across wrist on level between styloid processes of radius and ulna, at end of executed motion.

*Pronation* (A, fig. 17)

1 *Position*—Same as for supination
2 *Stationary arm*—Parallel to long axis of humerus with protractor lateral to wrist.
3 *Moving arm*—Same as for supination (Measurement with Gravity-Type Goniometer—fig. 2).

Ⓐ

*Figure 17.*



*Supination* (B, fig. 17)

1 *Position*—Sitting or standing with elbow flexed to 90°, forearm in mid-position between supination and pronation. Elbow held close to body.
2 *Technique*—Handle is grasped firmly as forearm is supinated

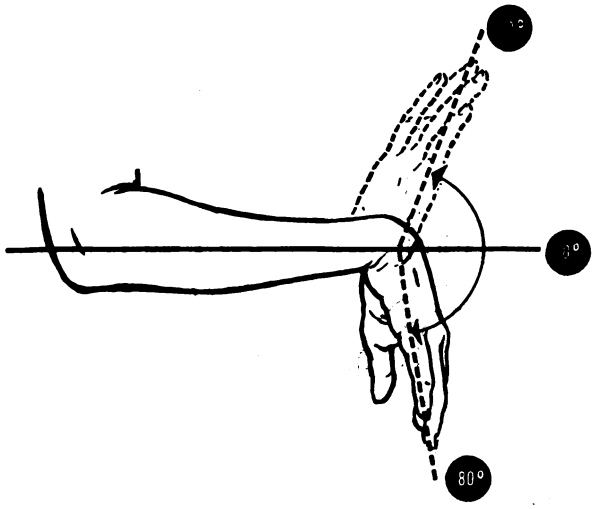
*Pronation* (B, fig. 17)

1 *Position*—Same as for supination
2 *Technique*—Handle is grasped firmly as forearm is pronated

Ⓑ

*Figure 17*—Continued.

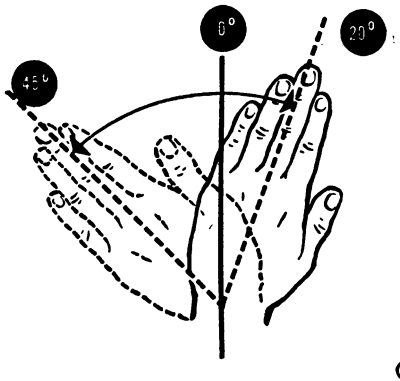
## 12. The Wrist




*Extention and Flexion* (A, fig. 18)

1 *Position*—Sitting or standing with elbow flexed and forearm in pronation
2 *Stationary arm*—Along lateral midline of forearm
3 *Moving arm*—Parallel to 5th metacarpal

Ⓐ



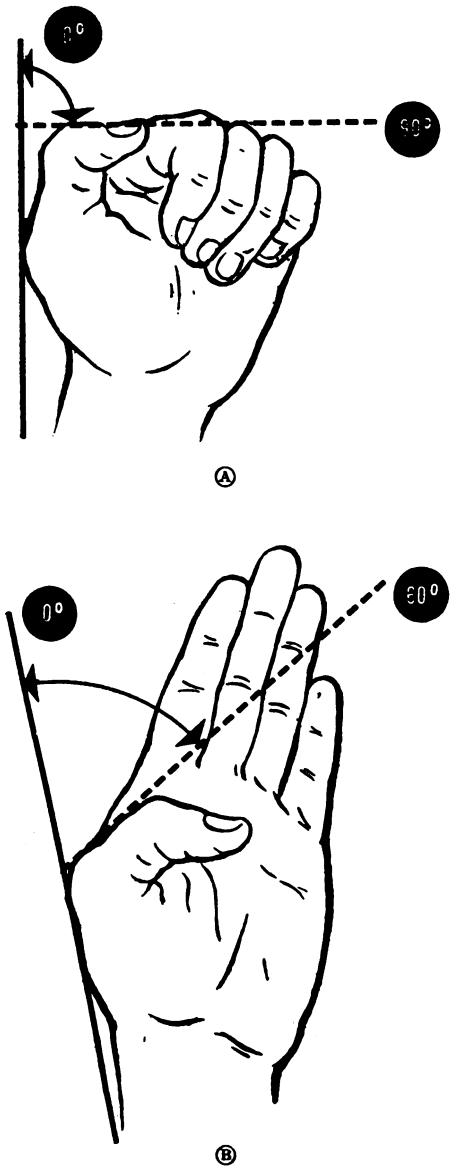

*Ulnar and Radial Deviation* (B, fig. 18).

1 *Position*—3d metacarpal in line with midline of the forearm.
2 *Stationary arm*—Along dorsal midline of forearm.
3 *Moving arm*—In line with 3d metacarpal.

Ⓑ

*Figure 18.*

## 13. The Thumb



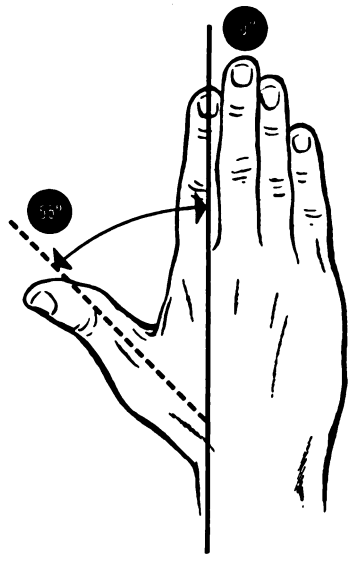

*Flexion and Extension* (A, and B, fig. 19).

1 *Position*—Wrist in neutral position.

2 *Stationary arm*—Along midline of dorsal surface of metacarpal or phalanx adjacent to joint being measured.

3 *Moving arm*—Along dorsal surface of phalanx distal to joint being measured.

*Figure 19.*



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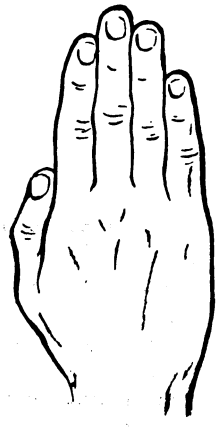

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*Radial Abduction and Ulnar Adduction* (C and D, fig. 19).

1 *Position*—Wrist in neutral position.
2 *Stationary arm*—Along dorsal surface of 2d metacarpal.
3 *Moving arm*—Along dorsal surface of 1st metacarpal.

*Figure 19*—Continued.

*Palmar Abduction and Adduction* (E and F, fig. 19)

1 *Position*—Wrist in neutral position
2 *Stationary arm*—Along lateral border of 2d metacarpal
3 *Moving arm*—Along dorsal surface of 1st metacarpal

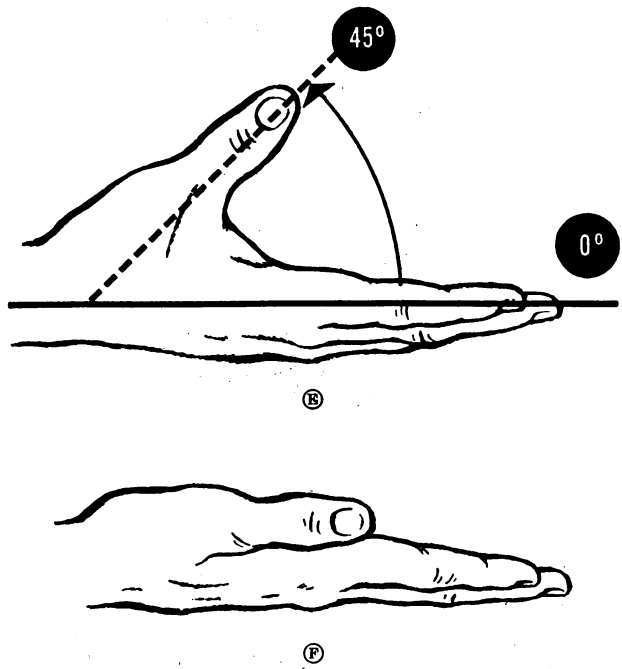



*Figure 19*—Continued.

## 14. The Fingers

*Flexion and Extension* (A, B and C, fig. 20)

1 *Position*—Wrist in extended or neutral position

2 *Stationary arm*—Along midline of dorsal surface of metacarpal or phalanx adjacent to joint being measured.

3 *Moving arm*—Along dorsal surface of phalanx distal to joint being measured.

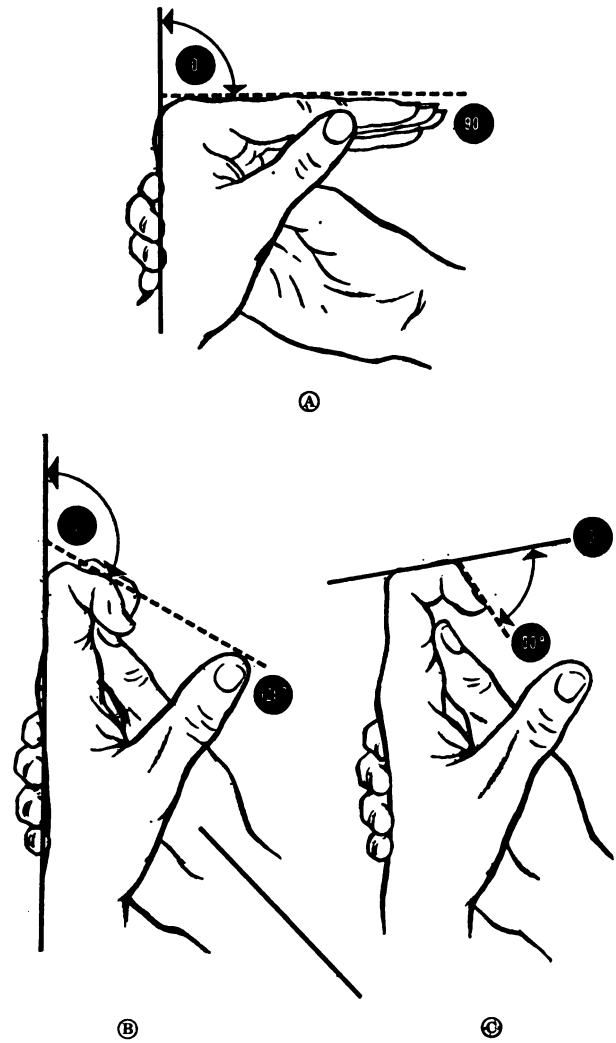
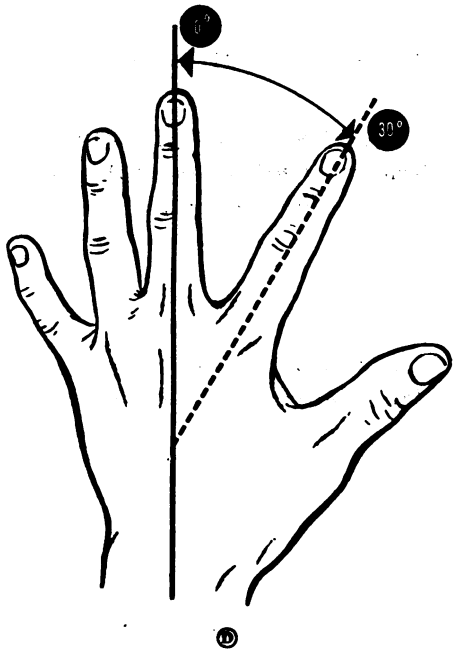



*Figure 20.*

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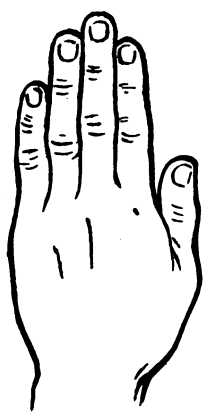

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*Abduction and Adduction* (D and E, fig. 20).

1 *Position*—Wrist in neutral position, fingers extended.
2 *Stationary arm*—Along midline of dorsal surface of finger next to the one being measured. (This finger to be in a neutral position.)
3 *Moving arm*—Along midline of dorsal surface of finger being measured.

*Figure 20*—Continued.

[AG 353 (8 Feb 56)]

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*NG:* State AG (6).

*USAR:* TOE 8–552R, 8–563R, 8–565R, 8–566R, 8–590R, (2).

For explanation of abbreviations used, see SR 320–50–1.

*Air Force:*

S

For explanation of distribution formula, see AFR 5–4.

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